Cardiovascular disease mortality based on verbal autopsy in low- and middle-income countries: a systematic review

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Objective To conduct a systematic review of verbal autopsy studies in low- and middle-income countries to estimate the fraction of deaths due to cardiovascular disease.

Method We searched MEDLINE®, Embase® and Scopus databases for verbal autopsy studies in low- and middle-income countries that reported deaths from cardiovascular disease. Two reviewers screened the studies, extracted data and assessed study quality. We calculated cause-specific mortality fractions for cardiovascular disease for each study, both overall and according to age, sex, geographical location and type of cardiovascular disease.

Findings We identified 42 studies for inclusion in the review. Overall, the cardiovascular disease cause-specific mortality fractions for people aged 15 years and above was 22.9%. This fraction was generally higher for males (24.7%) than females (20.9%), but the pattern varied across World Health Organization regions. The highest cardiovascular disease mortality fraction was reported in the Western Pacific Region (26.3%), followed by the South-East Asia Region (24.1%) and the African Region (12.7%). The cardiovascular disease mortality fraction was higher in urban than rural populations in all regions, except the South-East Asia Region. The mortality fraction for ischaemic heart disease (12.3%) was higher than that for stroke (8.7%). Overall, 69.4% of cardiovascular disease deaths were reported in people aged 65 years and above.

Conclusion The burden of cardiovascular disease deaths outside health-care settings in low- and middle-income countries is substantial. Increasing coverage of verbal autopsies in these countries could help fill gaps in cardiovascular disease mortality data and improve monitoring of national, regional and global health goals.

Abstracts in عربي, 中文, Français, Русский and Español at the end of each article.

Introduction

Cardiovascular disease is the largest cause of death due to noncommunicable disease globally. Data from the Global Burden of Disease (GBD) indicate that cardiovascular disease caused 18.5 million deaths worldwide in 2019, which corresponded to about 44% of all noncommunicable disease deaths.[1] These deaths occurred predominantly in people aged 70 years and older and were mainly due to ischaemic heart disease or stroke, for which the main preventable risk factors are high blood pressure, high blood sugar and cholesterol levels, obesity, air pollution, tobacco and poor diet.[1–3] Reportedly, 57% of premature deaths due to cardiovascular diseases in 2019 occurred in low- and middle-income countries, many of which are progressing through the epidemiological transition, and are experiencing a decline in infectious disease mortality along with a concurrent growth in cardiovascular disease mortality.[1,2] Hence, one target of the sustainable development goals is to reduce premature cardiovascular disease deaths by one third of the level recorded in 2015.[4]

In many low- and middle-income countries, however, the burden of cardiovascular disease mortality is unclear because civil registration and vital statistics systems are poor, and because accurate data on the cause of death is mostly unavailable outside health-care settings.[5–7] As a result, estimates of the cause of death in these countries have relied heavily on the modelling of data from the World Health Organization (WHO) and GBD studies. Furthermore, as the data available on cardiovascular disease mortality are limited, these estimates have wide uncertainty intervals. Moreover, the actual prevalence may have been underestimated and, consequently, understanding of the burden of cardiovascular disease in many populations may be inadequate.[2]

Verbal autopsy is the recommended method for providing routine information on the cause of death in low- and middle-income countries with low-quality or non-existent civil registration and vital statistics systems, and low coverage of medical certification of the cause of death.[8] The prime objective of verbal autopsy is to provide population estimates of the fraction of deaths due to different causes in places where a high proportion of people die at home.[9] Health and Demographic Surveillance System sites and epidemiological research have used verbal autopsy methods for over 50 years and these methods are increasingly being used as part of routine surveillance by civil registration and vital statistics systems.[9,10] In a verbal autopsy, an interviewer collects information on signs and symptoms and on any health care sought during the illness that led to a person's death, by questioning a close relative of the deceased person using a standardized questionnaire.[9] The most likely cause of death is assigned on the basis of the information collected either by physician-certified verbal autopsy, where at least two physicians review the information and disagreement is resolved by consensus or by a third physician, or by computer-coded verbal autopsy, which uses data-driven algorithms or diagnostic criteria developed by experts.[11] The use of verbal autopsy varies within regions and across countries. In 2022, a report by WHO's verbal autopsy reference group revealed that the method had been implemented in several

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Box 1. **Search strategies, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Medline (Ovid)

(Records retrieved: 176 on 6 September 2020 and 194 on 8 February 2022)

#1. verbal autops*.mp.
#2. stroke*.mp.
#3. cardio*.mp.
#4. cardia*.mp
#5. isch?em*.mp.
#6. coronary.mp.
#7. angina.mp.
#8. ventric*.mp.
#9. myocard*.mp.
#10. cerebrovasc*.mp.
#11. heart*.mp.
#12. hypertensi*.mp.
#13 (#2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12)
#1 AND #13

Embase

(Records retrieved: 273 on 6 September 2020 and 306 on 8 February 2022)

#1. verbal autops*.mp.
#2. stroke*.mp.
#3. cardio*.mp.
#4. cardia*.mp
#5. isch?em*.mp.
#6. coronary.mp.
#7. angina.mp.
#8. ventric*.mp.
#9. myocard*.mp.
#10. cerebrovasc*.mp.
#11. heart*.mp.
#12. hypertensi*.mp.
#13 (stroke* or cardio* or cardia* or isch?em* or coronary or angina or ventric* or myocard* or cerebrovasc* or heart* or hypertensi*).mp.
#1 AND #13

Scopus

(Records retrieved: 227 on 6 September 2020 and 248 on 8 February 2022)

#1 (TITLE-ABS-KEY ("verbal autops*"))
#2 (TITLE-ABS-KEY ("stroke*" or cardio* or cardia* or isch?em* or coronary or angina or ventric* or myocard* or cerebrovasc* or heart* or hypertensi*))
1 AND #2

low- and middle-income countries, the majority of which were in sub-Saharan Africa and South Asia.[9] As many countries in these regions do not have adequate death registration systems, verbal autopsies often provide the only source of information on mortality and the cause of death.[9,10] In contrast, countries and regions with good civil registration and vital statistics systems, such as the Americas, Australasia and Europe, rely less on verbal autopsy.[5]

Systematic reviews of mortality due to specific causes based on verbal autopsy studies are sparse. The aims of our systematic review of verbal autopsy studies were to estimate the fraction of deaths in low- and middle-income countries caused by cardiovascular disease and to describe how this fraction varies by age, sex, geographical location and type of cardiovascular disease.

Methods

All cross-sectional and surveillance studies (e.g. prospective monitoring studies from Health and Demographic Surveillance System sites) that reported deaths from cardiovascular diseases as ascertained by verbal autopsy in low- and middle-income countries were eligible for inclusion in the systematic review. We excluded: (i) studies conducted in specific groups (e.g. infants, females or stroke survivors); (ii) studies on validity, reliability or feasibility; (iii) pilot studies; (iv) maternal mortality and stillbirth studies; and (v) studies in which the study period overlapped with another study in the same country. Full details of all inclusion and exclusion criteria are available from the data repository.[12] We used Preferred Reporting Items for Systematic Reviews and Meta-Analyses checklists for this systematic review, and we developed the protocol and published it in the International Prospective Register of Systematic Reviews.[13,14]

Search strategy

The search strategy was devised with the support of a University of Melbourne librarian. We converted the research question into the PICO (i.e. population, intervention, comparator and outcome) format to identify keywords.[15] Then, we used Cochrane Library and PubMed medical subject heading (MeSH) on-demand tools to identify alternative terms for the keywords. We searched MEDLINE®, Embase® and Scopus databases from their inception to 6 September 2020. A separate search strategy was developed for each database (Box 1). The search was repeated on 8 February 2022 to identify new articles, and we included additional studies suggested by experts.

Study selection and data extraction

We used Covidence software (Covidence, Melbourne, Australia) to remove duplicate studies and manage the systematic review. Two reviewers screened titles and abstracts independently, with a third reviewer resolving any conflicts. After the full-text review, a data extraction form was developed and pre-tested on the first five studies identified by each of the two reviewers independently. After comparing the pre-testing results, the form was revised on the basis of consensus findings. Then, the two reviewers independently extracted data from all studies eligible for inclusion in the systematic review. Their findings were

compared and any discrepancies were resolved by consensus and with the help of a third reviewer.

From eligible studies, we extracted data on: (i) the study location; (ii) the study period; (iii) the type of study; (iv) the method of sample selection; (v) the verbal autopsy method used to ascertain the cause of death; (vi) whether the questionnaire was translated; (vii) the recall period for the interview; (viii) the characteristics of data collectors; (ix) the response rate; (x) the total number of verbal autopsy interviews; (xi) the number of deaths due to cardiovascular disease, stroke, ischaemic heart disease, and another or unspecified cardiac disease; (xii) whether deaths were reported by sex or age group; and (xiii) study limitations.

Risk of bias

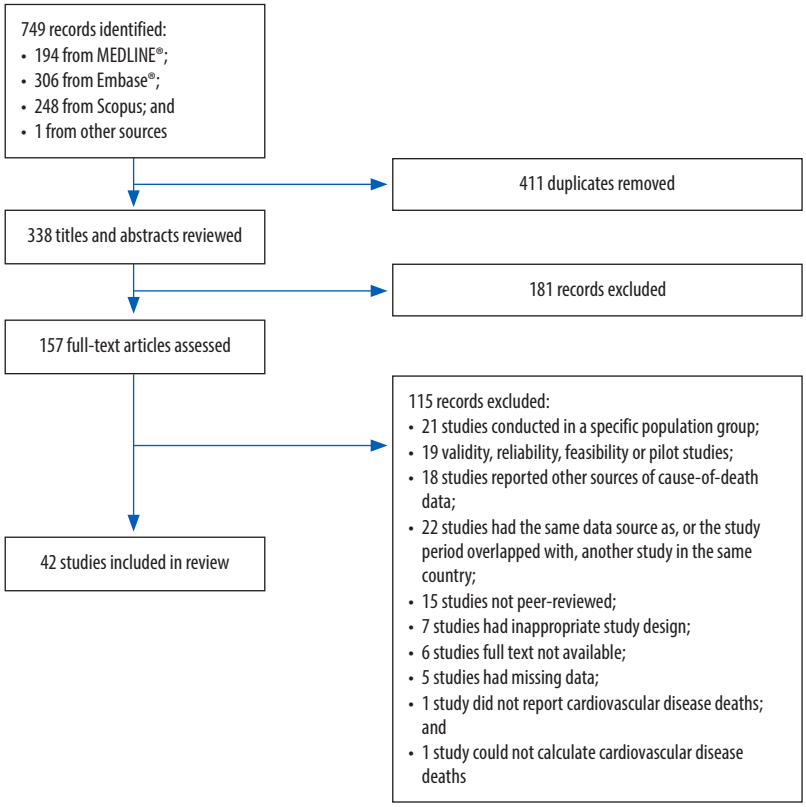
We assessed both the external and internal validity of each study included, and data quality was assessed from three broad perspectives using a pre-tested, risk-of-bias assessment tool: (i) selection of study population; (ii) non-response bias; and (iii) measurement bias.[16] We used six original items from the checklist of this tool (items 1 to 6) and four modified items from the checklist (items 7 to 10) based on our research questions. The resulting 10 items used to assess study bias were: (i) how well the study sample represented the national population; (ii) how well the study sampling frame corresponded to the target population; (iii) the sample selection process; (iv) the response rate; (v) case definitions; (vi) use of a validated questionnaire; (vii) the method used to ascertain the cause of death; (viii) the recall period; (ix) translation of the assessment tools; and (x) training of data collectors. Each item was assessed as having a high or low risk of bias and, in general, an item was categorized as high risk if the study provided unclear or insufficient information. No study was excluded from the review on the basis of its quality. Two reviewers conducted independent risk-of-bias assessments. Thereafter, their findings were compared and any discrepancies were resolved by consensus and with the help of a third reviewer.

Summary measures

Low- and middle-income countries were identified using the World Bank's classification for 2019 to 2020.[17] Cardiovascular diseases were defined using WHO's 2016 verbal autopsy list and the *International statistical classification of diseases and related health problems, 10th revision*.[9,18] The total number of cardiovascular disease deaths was calculated by summing the numbers of deaths from stroke, ischaemic heart disease and other cardiac diseases. The same method was used to calculate cardiovascular disease deaths by sex and age. We used consistent age ranges for all studies to derive age-based distributions. Data are presented as numbers and percentages.

The cause-specific mortality fraction (hereafter mortality fraction) was used to quantify the percentage of deaths in a population due to a particular cause. For each study, we calculated separate mortality fractions for all cardiovascular diseases, stroke, ischaemic heart disease and other cardiac diseases in individuals aged 15 years and above. For different age groups, the cardiovascular disease cause-specific mortality fraction was calculated as the total number of cardiovascular disease deaths in that age group divided by the total number of deaths reported by verbal autopsy in the same age group. We also calculated mortality fractions for these conditions for each sex. Low- and middle-income countries were grouped together into WHO regions. To calculate regional mortality fractions, we added all cardiovascular disease deaths and verbal autopsy deaths, respectively, reported by countries in the same WHO region. Regional mortality fractions for stroke, ischaemic heart disease and other cardiac diseases were calculated using the same method.

Fig. 1. **Study selection, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**



Results

In total, 749 studies were identified from the database search and experts' suggestions. After 411 duplicate publications were removed, the titles and abstracts of 338 studies were screened, 157 studies underwent full-text review and 42 were finally included in the systematic review (Fig. 1).

Study characteristics

The verbal autopsy data collection period of the studies included in the review ranged from 1992 to 2020

Table 1. **Study characteristics, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Study[a]	Country	Study setting	Verbal autopsy period	Study design	No. deaths recorded by verbal autopsy					
					All age groups			People aged ≥ 15 years		
					Total[b]	Male	Female	Total[b]	Male	Female
African Region (*n* = 22)										
Ndila et al., 2014[19]	Kenya	Urban and rural	2008–2011	Surveillance	4 460	2304	2156	3 310	ND	ND
Chisumpa et al., 2019[20]	Zambia	Urban and rural	2010–2012	Cross-sectional	ND	ND	ND	1 078	582	496
Soura et al., 2014[21]	Burkina Faso	Urban	2009–2011	Surveillance	870	ND	ND	ND	ND	ND
Ashenafi et al., 2017[22]	Ethiopia	Urban and rural	2008–2013	Surveillance	ND	ND	ND	1 535	855	680
Jasseh et al., 2014[23]	Gambia	Urban and rural	1998–2007	Surveillance	2 275	1217	1058	1 619	ND	ND
Abera et al., 2017[24]	Ethiopia	Urban and rural	2009–2015	Surveillance	ND	ND	ND	1 091	547	544
Vusirikala et al., 2019[25]	Kenya	Urban	2008–2018	Cross-sectional	ND	ND	ND	410	ND	ND
Koné et al., 2015[26]	Côte d'Ivoire	Rural	2009–2011	Surveillance	712	386	326	375	218	157
Levira et al., 2019[27]	United Republic of Tanzania	Urban and rural	2011–2014	Cross sectional	5 225	ND	ND	3 257	ND	ND
Mossong et al., 2014[28]	South Africa	Rural	2000–2011	Surveillance	10 958	5140	5818	9 161	ND	ND
Dalinjong et al., 2015[29]	Ghana	Urban and rural	2004–2011	Surveillance	4 021	ND	ND	3 492	2 125	1 367
Kynast-Wolf et al., 2010[30]	Burkina Faso	Rural	1999–2003	Surveillance	1 238	ND	ND	1 238	ND	ND
Rosário et al., 2016[31]	Angola	Urban and rural	2009–2012	Surveillance	934	492	442	407	222	185
Phillips-Howard et al., 2014[32]	Kenya	Rural	2003–2010	Surveillance	ND	ND	ND	15 228	7 295	7 933
Challe et al., 2018[33]	United Republic of Tanzania	Urban and rural	2006–2012	Surveillance	1 325	715	610	713	ND	ND
Awini et al., 2014[34]	Ghana	Rural	2006–2010	Surveillance	3 005	ND	ND	2 547	1 023	1 257
Sifuna et al., 2018[35]	Kenya	Rural	2011–2015	Surveillance	3 903	2063	1840	3 001	1 605	1 396
Walker et al., 2000[36]	United Republic of Tanzania	Urban and rural	1992–1995	Surveillance	11 975	ND	ND	7 629	4 088	3 541
Alabi et al., 2014[37]	Nigeria	Rural	2009–2012	Surveillance	2 050	ND	ND	ND	ND	ND
Natukwatsa et al., 2021[38]	Uganda	Urban and rural	2010–2016	Surveillance	ND	ND	ND	1 210	597	613
Newberry Le Vay et al., 2021[39]	South Africa	Rural	1993–2015	Surveillance	15 305	ND	ND	ND	ND	ND
Fenta et al., 2021[40]	Ethiopia	ND	2007–2017	Surveillance	ND	ND	ND	7 911	4 137	3 774
South-East Asia Region (*n* = 13)										
Joshi et al., 2006[41]	India	Rural	2003–2004	Surveillance	1 329	ND	ND	1 251	ND	ND
Alam et al., 2014[42]	Bangladesh	Rural	2003–2010	Surveillance	12 113	6565	5548	9 777	ND	ND
Madhavan et al., 2011[43]	India	Rural	2006–2007	Surveillance	1 827	1007	820	ND	ND	ND
Alam et al., 2014[44]	Bangladesh	Rural	2004–2010	Surveillance	3 231	1759	1472	2 662	ND	ND
Ke et al., 2018[45]	India	Urban and rural	2000–2013	Cross-sectional	ND	ND	ND	472 113	270 000	202 000

(*continues*. . .)

(*...continued*)

Study[a]	Country	Study setting	Verbal autopsy period	Study design	No. deaths recorded by verbal autopsy					
					All age groups			People aged ≥ 15 years		
					Total[b]	Male	Female	Total[b]	Male	Female
Singh et al., 2007[46]	India	Urban	1999–2001	Cross-sectional	ND	ND	ND	2 222	1 385	837
Saha et al., 2007[47]	India	Urban	1994–2004	Cross-sectional	515	340	175	411	ND	ND
Wahab et al., 2017[48]	Indonesia	Rural	2000–2002	Surveillance	830	399	431	775	ND	ND
Rai et al., 2015[49]	India	Rural	2002–2011	Surveillance	ND	ND	ND	4 140	2 508	1 632
Kalkonde et al., 2019[50]	India	Rural	2011–2013	Surveillance	1 599	869	730	1 417	ND	ND
Kanungo et al., 2010[51]	India	Urban	2003–2004	Surveillance	544	322	222	ND	ND	ND
Rai et al., 2020[52]	India	Rural	2012–2017	Surveillance	2 320	1348	972	2 094	1 227	867
Shawon et al., 2021[53]	Bangladesh	Rural	2017–2019	Cross-sectional	22 535	ND	ND	ND	ND	ND
Western Pacific Region (*n* = 5)										
Phuong Hoa et al., 2012[54]	Viet Nam	Urban and rural	2008–2009	Surveillance	9 919	5704	4215	9 892	5 700	4 192
Huong et al., 2006[55]	Viet Nam	Rural	1999–2003	Surveillance	1 220	657	563	ND	ND	ND
Ngo et al., 2010[56]	Viet Nam	ND	2006–2007	Cross-sectional	6 798	4078	2727	6 298	3 781	2 517
Gouda et al., 2019[57]	Papua New Guinea	Urban and rural	2009–2014	Surveillance	1 094	ND	ND	ND	ND	ND
Reeve et al., 2021[58]	Solomon Islands	ND	2016–2020	Surveillance	1 034	636	397	ND	ND	ND
Eastern Mediterranean Region (*n* = 1)										
Abbas et al., 2011[59]	Pakistan	Urban	2010	Cross-sectional	ND	ND	ND	300	191	109
European Region (*n* = 1)										
Akgün et al., 2012[60]	Türkiye	Urban and rural	2002–2004	Cross-sectional	1 089	633	456	ND	ND	ND

ND: not determined.

[a] We grouped studies by World Health Organization region.

[b] For some studies, the total number of participants does not equal the sum of male and female participants because of rounding or reporting errors.

(Table 1).[36,58] More than half the studies (24/42) were published between 2000 and 2015.[19,21,23,26,28–30,32,34,36,37,41–44,46,47,49,51,54–56,59,60] Studies came from 20 low- and middle-income countries, and covered all WHO regions except for the Region of the Americas. Twenty-two studies were conducted in the African Region,[19–40] compared with 13 in the South-East Asia Region,[41–53] five in the Western Pacific Region,[54–58] one in the Eastern Mediterranean Region,[59] and one in the European Region.[60] More than three quarters of the studies (32/42) were surveillance studies.[19,21–24,26,28–44,48–52,54,55,57,58] Of 39 studies that recorded the study setting,[19–39,41–55,57,59,60] 18 covered rural populations,[26,28,30,32,34,35,37,39,41–44,48–50,52,53,55] six covered urban populations,[21,25,46,47,51,59] and 15 covered both rural and urban populations at the country level.[19,20,22–24,27,29,31,33,36,38,45,54,57,60] The number of verbal autopsy deaths reported across all ages ranged between studies from 515 to 22 535,[47,53] and 20 studies reported deaths by sex.[19,23,26,28,31,33,35,42–44,47,48,50–52,54–56,58,60]. Thirty-two studies reported the number of verbal autopsy deaths in people aged 15 years and above; this number ranged from 300 to 472 113.[45,59]

Cardiovascular disease mortality fraction

In total, the 42 studies recorded 129 482 deaths due to cardiovascular disease in individuals aged 15 years and above (Table 2). At the country level, the cardiovascular disease mortality fraction in people aged 15 years or older ranged from 5.5% in Zambia and the United Republic of Tanzania to 63.7% in Pakistan.[20,36,59] In just over half the studies (22/42), the cause of death was ascertained by physicians; [22,24,27–31,33,36–38,40,41,43,45,49–52,54–56,60] in 15 studies, cardiovascular disease deaths were ascertained using InterVA (Umeå Centre for Global Health Research, Umeå, Sweden) or SmartVA (Institute for Health Metrics and Evaluation, Seattle, USA) software.[19,21,23,25,26,32,34,35,39,42,44,48,53,57,58]

Overall, the cardiovascular disease mortality fraction was 21.3% across all age groups and 22.9% in people aged 15 years or older (Table 2). By WHO region, the cardiovascular disease mortality fraction in people aged 15 years or older was 26.3% in the Western Pacific Region; 24.1% in the South-East Asia Region; and 12.7% in the African Region.

Table 2. **Cause-specific mortality fraction for cardiovascular disease, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Study[a]	Study country	No. deaths recorded by verbal autopsy						No. deaths due to cardiovascular disease						CSMF for cardiovascular disease, %						Verbal autopsy method[b]
		All age groups			People aged ≥ 15 years			All age groups			People aged ≥ 15 years			All age groups			People aged ≥ 15 years			
		Total[c]	Male	Female	Total[c]	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	
African Region (*n* = 22)																				
Ndila[19]	Kenya	ND	ND	ND	3 310	ND	ND	ND	ND	ND	544	ND	ND	ND	ND	ND	16.4	ND	ND	InterVA-4 software
Chisumpa[20]	Zambia	ND	ND	ND	1 078	582	496	ND	ND	ND	59	27	32	ND	ND	ND	5.5	4.6	6.5	ND
Soura[21]	Burkina Faso	870	ND	ND	ND	ND	ND	116	ND	ND	ND	ND	ND	13.3	ND	ND	ND	ND	ND	InterVA-4 software
Ashenafi[22]	Ethiopia	ND	ND	ND	1 535	855	680	ND	ND	ND	163	ND	ND	ND	ND	ND	10.6	ND	ND	Physician-certified
Jasseh[23]	Gambia	ND	ND	ND	1 619	ND	ND	ND	ND	ND	189	ND	ND	ND	ND	ND	11.7	ND	ND	InterVA-4 software
Abera[24]	Ethiopia	ND	ND	ND	1 091	547	544	ND	ND	ND	157	76	81	ND	ND	ND	14.4	13.9	14.9	Physician-certified
Vusirikala[25]	Kenya	ND	ND	ND	410	ND	ND	ND	ND	ND	91	41	47	ND	ND	ND	22.2	ND	ND	InterVA-4 software
Koné[26]	Côte d'Ivoire	ND	ND	ND	375	218	157	ND	ND	ND	25	18	7	ND	ND	ND	6.7	8.3	4.5	InterVA-4 software
Levira[27]	United Republic of Tanzania	5 225	ND	ND	ND	ND	ND	86	38	48	ND	ND	ND	1.6	ND	ND	ND	ND	ND	Physician-certified
Mossong[28]	South Africa	ND	ND	ND	9 161	ND	ND	ND	ND	ND	967	ND	ND	ND	ND	ND	10.6	ND	ND	Physician-certified
Dalinjong[29]	Ghana	ND	ND	ND	3 492	2 125	1 367	ND	ND	ND	371	220	151	ND	ND	ND	10.6	10.4	11	Physician-certified
Kynast-Wolf[30]	Burkina Faso	ND	ND	ND	1 238	ND	ND	ND	ND	ND	113	ND	ND	ND	ND	ND	9.1	ND	ND	Physician-certified
Rosário[31]	Angola	ND	ND	ND	407	222	185	ND	ND	ND	59	24	35	ND	ND	ND	14.5	10.8	18.9	Physician-certified
Phillips-Howard[32]	Kenya	ND	ND	ND	15 228	7 295	7 933	ND	ND	ND	1384	595	789	ND	ND	ND	9.1	8.2	9.9	InterVA-4 software
Challe[33]	United Republic of Tanzania	ND	ND	ND	713	ND	ND	ND	ND	ND	112	ND	ND	ND	ND	ND	15.7	ND	ND	Physician-certified
Awini[34]	Ghana	ND	ND	ND	2 547	1 023	1 257	ND	ND	ND	419	176	243	ND	ND	ND	16.5	17.2	19.5	InterVA-4 software
Sifuna[35]	Kenya	ND	ND	ND	3 001	1 605	1 396	ND	ND	ND	397	ND	ND	ND	ND	ND	13.2	ND	ND	InterVA-4 software
Walker[36]	United Republic of Tanzania	ND	ND	ND	7 629	4 088	3 541	ND	ND	ND	421	225	196	ND	ND	ND	5.5	5.5	5.5	Physician-certified
Alabi[37]	Nigeria	2 050	ND	ND	ND	ND	ND	17	ND	ND	ND	ND	ND	0.8	ND	ND	ND	ND	ND	Physician-certified
Natukwatsa[38]	Uganda	ND	ND	ND	1 210	597	613	ND	ND	ND	260	ND	ND	ND	ND	ND	21.5	ND	ND	Physician-certified
Newberry[39]	South Africa	15 305	ND	ND	ND	ND	ND	1 434	ND	ND	ND	ND	ND	9.4	ND	ND	ND	ND	ND	InterVA-5 software
Fenta[40]	Ethiopia	ND	ND	ND	7 911	4 137	3 774	ND	ND	ND	2 149	1 097	1 052	ND	ND	ND	27.2	26.5	27.9	Physician-certified
Total	NA	23 450	ND	ND	61 955	ND	ND	1 653	ND	ND	7 880	ND	ND	7.0	ND	ND	12.7	ND	ND	NA
South-East Asia Region (*n* = 13)																				
Joshi[41]	India	ND	ND	ND	1 251	ND	ND	ND	ND	ND	431	229	202	ND	ND	ND	34.5	ND	ND	Physician-certified
Alam[42]	Bangladesh	ND	ND	ND	9 777	ND	ND	ND	ND	ND	3 008	1 547	1 461	ND	ND	ND	30.8	ND	ND	InterVA-4 software

(*continues*. . .)

(. . .*continued*)

Study[a]	Study country	No. deaths recorded by verbal autopsy						No. deaths due to cardiovascular disease						CSMF for cardiovascular disease, %						Verbal autopsy method[b]
		All age groups			People aged ≥ 15 years			All age groups			People aged ≥ 15 years			All age groups			People aged ≥ 15 years			
		Total[c]	Male	Female	Total[c]	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	
Madhavan[43]	India	1 827	1007	820	ND	ND	ND	553	ND	ND	ND	ND	ND	30.3	ND	ND	ND	ND	ND	Physician-certified
Alam[44]	Bangladesh	ND	ND	ND	2 662	ND	ND	ND	ND	ND	903	ND	ND	ND	ND	ND	33.9	ND	ND	InterVA-4 software
Ke[45]	India	ND	ND	ND	472 113	270 000	202 000	ND	ND	ND	111 977	68 904	43 073	ND	ND	ND	23.7	25.5	21.3	Physician-certified
Singh[46]	India	ND	ND	ND	2 222	1 385	837	ND	ND	ND	646	406	240	ND	ND	ND	29.1	29.3	27.4	ND
Saha[47]	India	ND	ND	ND	411	ND	ND	ND	ND	ND	42	26	16	ND	ND	ND	10.2	ND	ND	Medical officer-certified
Wahab[48]	Indonesia	ND	ND	ND	775	ND	ND	ND	ND	ND	318	ND	ND	ND	ND	ND	41	ND	ND	InterVA-4 software
Rai[49]	India	ND	ND	ND	4 140	2 508	1 632	ND	ND	ND	1 413	895	518	ND	ND	ND	34.1	35.7	31.7	Physician-certified
Kalkonde[50]	India	ND	ND	ND	1 417	ND	ND	ND	ND	ND	332	175	157	ND	ND	ND	23.4	ND	ND	Physician-certified
Kanungo[51]	India	544	322	222	ND	ND	ND	198	106	92	ND	ND	ND	36.4	32.9	41.4	ND	ND	ND	Physician-certified
Rai[52]	India	ND	ND	ND	2 094	1227	867	ND	ND	ND	685	358	327	ND	ND	ND	32.7	29.2	37.7	Physician-certified
Shawon[53]	Bangladesh	22 535	ND	ND	ND	ND	ND	9 331	5 759	3 572	ND	ND	ND	41.4	ND	ND	ND	ND	ND	SmartVA software
Total	NA	24 906	ND	ND	496 862	ND	ND	10 082	ND	ND	119 755	ND	ND	40.5	ND	ND	24.1	ND	ND	NA
Western Pacific Region (*n* = 5)																				
Phuong Hoa[54]	Viet Nam	9 919	5704	4215	ND	ND	ND	629	209	420	ND	ND	ND	6.3	3.7	10.0	ND	ND	ND	Physician-certified
Huong[55]	Viet Nam	1 220	657	563	ND	ND	ND	353	193	160	ND	ND	ND	28.9	29.4	28.4	ND	ND	ND	Physician-certified
Ngo[56]	Viet Nam	6 798	4078	2727	6 298	3 781	2 517	ND	ND	ND	1 656	884	772	ND	ND	ND	26.3	23.4	30.7	Physician-certified
Gouda[57]	Papua New Guinea	1 094	ND	ND	ND	ND	ND	69	38	31	ND	ND	ND	6.3	ND	ND	ND	ND	ND	SmartVA software
Reeve[58]	Solomon Islands	1 034	636	397	ND	ND	ND	281	195	86	ND	ND	ND	27.2	30.7	21.7	ND	ND	ND	SmartVA software
Total	NA	13 267	ND	ND	6 298	ND	ND	1 332	ND	ND	1 656	ND	ND	10.0	ND	ND	26.3	ND	ND	NA
Eastern Mediterranean Region (*n* = 1)																				
Abbas[59]	Pakistan	ND	ND	ND	300	191	109	ND	ND	ND	191	ND	ND	ND	ND	ND	63.7	ND	ND	ND
Total	NA	ND	ND	ND	300	ND	ND	ND	ND	ND	191	ND	ND	ND	ND	ND	63.7	ND	ND	NA
European Region (*n* = 1)																				
Akgün[60]	Türkiye	1 089	633	456	ND	ND	ND	314	183	131	ND	ND	ND	28.8	28.9	28.7	ND	ND	ND	Physician-certified
Total	NA	1 089	ND	ND	ND	ND	ND	314	ND	ND	ND	ND	ND	28.8	ND	ND	ND	ND	ND	NA
Total for all regions	**NA**	62 712	**ND**	**ND**	565 415	**ND**	**ND**	13 381	**ND**	**ND**	129 482	**ND**	**ND**	**21.3**	**ND**	**ND**	**22.9**	**ND**	**ND**	**NA**

CSMF: cause-specific mortality fraction; NA: not applicable; ND: not determined.

[a] Countries were grouped by World Health Organization region.

[b] The results of verbal autopsies were either certified by a physician or medical officer or coded using a data-driven computer algorithm, such as InterVA or SmartVA.

[c] For some studies, the total number of participants does not equal the sum of male and female participants because of rounding or reporting errors.

(*continues*. . .)

Fourteen studies reported both cardiovascular disease deaths by sex and verbal autopsy deaths in people aged 15 years or older (Table 2).[20,24,26,29,31,32,34,36,40,45,46,49,52,56] Overall, the cardiovascular disease mortality fraction was higher in males than females: 24.7% versus 20.9%, respectively (Table 3). Although the pattern was similar in the South-East Asia Region, the cardiovascular disease mortality fraction was higher in females than males in the African and Western Pacific Regions.

Study setting

Sixteen studies reported the number of verbal autopsy deaths and the number of cardiovascular disease deaths in people aged 15 years or older by rural or urban residence: 13 were performed in rural areas and three were performed in urban areas (Table 4).[25,26,28,30,32,34,35,41,42,44,46–50,52] Overall, the cardiovascular disease mortality fraction was higher in urban than in rural settings: 25.6% versus19.4%, respectively. In the African Region, the cardiovascular disease mortality fraction was higher in urban than rural populations (22.2% versus 10.5%, respectively), whereas in the South-East Asia Region it was higher in rural than urban populations (32.1% versus 26.1%, respectively).

Differences by age

Seven studies reported cardiovascular disease deaths in the age groups 15 to 49 years, 50 to 64 years and 65 years or older (Table 5).[19,26,28,34,35,42,44] In these studies, 69.4% of cardiovascular disease deaths were reported in people aged 65 years or older, and 20.2% were reported in people aged 50 to 64 years. Six studies reported cardiovascular disease deaths in the age groups 15 to 59 years and 60 years or older (Table 6).[23,33,41,49,50,56] Among these studies, 80.5% of cardiovascular disease deaths were reported in people aged 60 years or older.

Type of cardiovascular disease

Overall in people aged 15 years or older, the mortality fraction for ischaemic heart disease (12.3%) was higher than that for stroke (8.7%) and for other or unspecified heart disease (1.5%; Table 7). The pattern was similar in the South-East Asia Region. In the African Region, however, the mortality fraction for stroke (4.2%) was higher than that for ischaemic heart disease (0.8%).

Risk of bias

The findings of the risk-of-bias assessments in the 42 studies are shown in Fig. 2. Overall, 83% (35/42) of studies had poorly reported or unclear information on how representative the study target population was of the national population. Moreover, 76% (32/42) of studies did not report whether the verbal autopsy questionnaire had been translated into a local language. Information on whether the recall period between the person's death and the verbal autopsy was appropriate (i.e. under 3 months) was either absent or unclear in 64% (27/42) of studies. Full details of the risk-of-bias assessments for individual studies are available from the data repository.[12]

Discussion

We found that the overall cardiovascular disease mortality fraction among people in low- and middle-income countries aged 15 years or older was 22.9%, and that the mortality fraction was generally higher in males than females. Moreover, the mortality fraction varied with age, geographical location and the type of cardiovascular disease. The highest burden of cardiovascular disease deaths was reported in WHO's Western Pacific Region, followed by the South-East Asia Region and the African Region. The cardiovascular disease mortality fraction was higher in urban than rural populations in all regions except the South-East Asia Region. We also found that the mortality fraction was generally higher for ischaemic heart disease than stroke, though stroke deaths were more common in Africa.

Verbal autopsy is an important data source for the GBD, which produces global, regional and national estimates of the frequency of different causes of death.[1] Our review provides new data on cardiovascular disease mortality from published verbal autopsy studies that may not previously have been included in GBD estimates, and which could increase the representativeness of global estimates. Moreover, our review provides data on rural and urban populations and on regions where information on cardiovascular disease mortality is scarce because there is no adequate death registration system. The inclusion of verbal autopsy data from regions and population groups that are underrepresented in existing global estimates will help make estimates for these regions more balanced and accurate. Although our review did not include data from the WHO Region of the Americas, verbal autopsy is not needed in most of the region because the cause of death is recorded by medical certification,

Table 3. **Cause-specific mortality fraction for cardiovascular disease, by sex and WHO region, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

WHO region	No. studies	Parameter for people aged ≥ 15 years								
		No. deaths recorded by verbal autopsy			No. deaths due to cardiovascular disease			Cause-specific mortality fraction for cardiovascular disease, %		
		Total[a]	Male	Female	Total	Male	Female	Total	Male	Female
African[20,24,26,29,31,32,34,36,40]	9	39 758	20 237	19 254	5 044	2 458	2 586	12.7	12.1	13.4
South-East Asia[45,46,49,52]	4	480 569	275 120	205 374	114 721	70 563	44 158	23.9	25.6	21.5
Western Pacific[56]	1	6 298	3 781	2 517	1 656	884	772	26.3	23.4	30.7
Total	14	526 625	299 138	227 145	121 421	73 905	47 516	23.1	24.7	20.9

WHO: World Health Organization.
[a] For some regions, the total number of participants does not equal the sum of male and female participants because of rounding or reporting errors in individual studies.

except in some very remote communities where verbal autopsy is used (e.g. in Colombia).[61]

Although our findings may not be generalizable to a global or national level, a comparison with GBD estimates is helpful. Our overall estimate of the cardiovascular disease mortality fraction of 22.9% is lower than that estimated by the 2019 GBD study (the most recent), which found a cardiovascular disease mortality fraction of 32% across all age groups globally.[1] In addition, our review found a higher cardiovascular disease mortality fraction in males than females overall, which was not in agreement with the 2019 GBD estimates.[1] Nevertheless, the regional sex differences in cardiovascular disease mortality fraction we found in our review were consistent with GBD estimates.[1] Our observations that the mortality fraction for ischaemic heart disease was higher than that for stroke, and that the cardiovascular disease mortality fraction was higher in older than younger age groups, were similar to GBD findings.[1]

The differences between our review's findings and GBD estimates could be due to the lack of generalizability of our study data. Our review included few studies from the Western Pacific, Eastern Mediterranean or European Regions, or from high-income countries where death due to cardiovascular disease is more common.[1] In addition, the studies included in our review mainly focused on deaths at home, which are most frequently assessed by verbal autopsy. By contrast, the GBD estimates mortality fractions for all deaths in all countries and regions.[2] Moreover, GBD estimates of the global cardiovascular disease mortality fraction are affected by a lack of data from some countries, notably countries with a high proportion of deaths in the community, such as those in sub-Saharan Africa and South-East Asia,[3] which may help explain why our cardiovascular disease mortality fraction estimates were lower. Our review suggests that the verbal autopsy method can help fill gaps in cardiovascular disease mortality data for low- and middle-income countries that do not have adequate vital registration systems, and can be a valuable tool for identifying different types of cardiovascular death in the community.

Most studies (32/42) in our review were surveillance studies and did not report whether the study population was comparable with the national population in terms of age, sex, socioeconomic status or any other factor. Surveillance studies would be more valuable if they reported the characteristics of the study population, which, in turn, would help establish the generalizability of the study's findings. Moreover, to minimize assessment errors, studies should report

Table 4. **Cause-specific mortality fraction for cardiovascular disease, by study setting and WHO region, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Study setting and WHO region	No. studies	Parameter for people aged ≥ 15 years		
		No. deaths recorded by verbal autopsy	No. deaths due to cardiovascular disease	Cause-specific mortality fraction for cardiovascular disease, %
Rural				
African[26,28,30,32,34,35]	6	31 550	3 305	10.5
South-East Asia[41,42,44,48–50,52]	7	22 116	7 090	32.1
Total	13	53 666	10 395	19.4
Urban				
African[25]	1	410	91	22.2
South-East Asia[46,47]	2	2 633	688	26.1
Total	3	3 043	779	25.6

WHO: World Health Organization.

Table 5. **Cardiovascular disease deaths, by age group (15–49 years, 50–64 years and ≥ 65 years), systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Study author, country	Cardiovascular disease deaths			
	All age groups[a]	15–49 years	50–64 years	≥ 65 years
Alam, Bangladesh[42]	3008	242	559	2167
Ndila, Kenya[19]	544	64	116	364
Koné, Côte d'Ivoire[26]	25	4	6	15
Mossong, South Africa[28]	969	103	230	634
Alam, Bangladesh[44]	903	86	185	632
Awini, Ghana[34]	419	53	104	262
Sifuna, Kenya[35]	398	59	66	272
Total (%)	**6266 (100)**	**611 (9.8)**	**1266 (20.2)**	**4346 (69.4)**

[a] For some studies, the number for all age groups also included individuals aged under 15 years.

Table 6. **Cardiovascular disease deaths, by age group (15–59 years and ≥ 60 years), systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

Study author, country	Cardiovascular disease deaths		
	All age groups[a]	15–59 years	≥ 60 years
Joshi, India[41]	431	124	310
Jasseh, Gambia[23]	196	44	145
Ngo, Viet Nam[56]	1656	201	1455
Kalkonde, India[50]	332	100	232
Challe, United Republic of Tanzania[33]	112	11	101
Rai, India[49]	685	182	502
Total (%)	**3412 (100)**	**663 (19.4)**	**2745 (80.5)**

[a] For some studies, the number for all age groups also included individuals aged under 15 years.

Table 7. **Cause-specific mortality fraction, by type of cardiovascular disease, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**

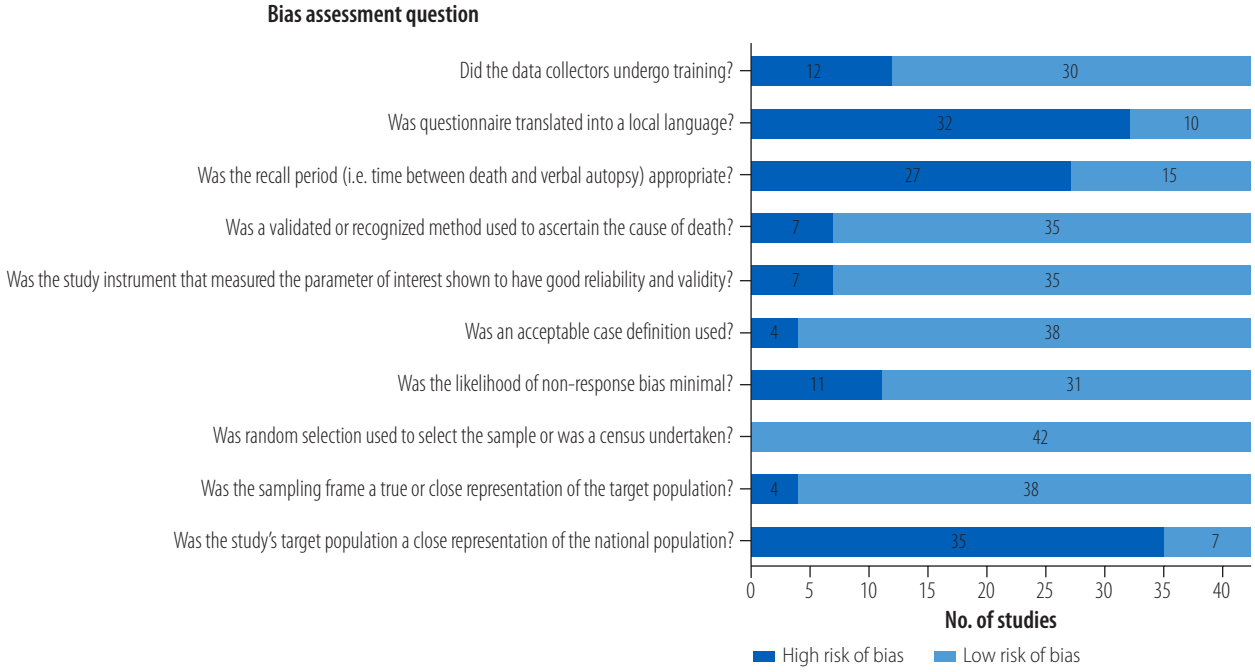
Study author, country[a]	Verbal autopsy findings in people aged ≥ 15 years						
	Total deaths (*n*)	Stroke		Ischaemic heart disease		Other and unspecified cardiac disease	
		No. deaths	Cause-specific mortality fraction, %	No. deaths	Cause-specific mortality fraction, %	No. deaths	Cause-specific mortality fraction, %
African Region (*n* = 13)							
Ndila, Kenya[19]	3 310	317	9.6	33	1.0	194	5.9
Ashenafi, Ethiopia[22]	1 535	64	4.2	30	2.0	69	4.5
Jasseh, Gambia[23]	1 619	146	9.0	ND	ND	43	2.7
Abera, Ethiopia[24]	1 091	83	7.6	26	2.4	48	4.4
Koné, Côte d'Ivoire[26]	375	9	2.4	1	0.3	15	4.0
Mossong, South Africa[28]	9 161	403	4.4	55	0.6	509	5.6
Kynast-Wolf, Burkina Faso[30]	1 238	15	1.2	ND	ND	ND	ND
Phillips-Howard, Kenya[32]	15 228	327	2.1	100	0.7	957	6.3
Challe, United Republic of Tanzania[33]	713	41	5.8	ND	ND	71	10.0
Awini, Ghana[34]	2 547	219	8.6	147	5.8	53	2.1
Sifuna, Kenya[35]	3 001	201	6.7	74	2.5	122	4.1
Walker, United Republic of Tanzania[36]	7 629	421	5.5	ND	ND	ND	ND
Fenta, Ethiopia[40]	7 911	81	1.0	ND	ND	155	2.0
Total	55 358	2327	4.2	466	0.8	2236	4.0
South-East Asia Region (*n* = 10)							
Joshi, India[41]	1 251	170	13.6	183	14.6	78	6.2
Alam, Bangladesh[44]	9 777	2144	21.9	863	8.8	ND	ND
Alam, Bangladesh[42]	2 662	569	21.4	335	12.6	ND	ND
Ke, India[45]	472 113	41 000	8.7	66 000	14.0	5000	1.1
Singh, India[46]	2 222	175	7.9	267	12.0	204	9.2
Saha, India[47]	411	ND	ND	42	10.2	42	10.2
Wahab, Indonesia[48]	775	213	27.5	9	1.2	96	12.4
Rai, India[52]	4 140	122	2.9	426	10.3	53	1.3
Kalkonde, India[50]	1 417	229	16.2	69	4.9	7	0.5
Rai, India[52]	2 094	558	26.6	91	4.3	33	1.6
Total	496 862	45 180	9.1	68 285	13.7	5513	1.1
Western Pacific Region (*n* = 1)							
Ngo, Viet Nam[56]	6 298	1139	18.1	136	2.2	381	6.0
Total	6 298	1139	18.1	136	2.2	381	6.0
Total for all regions	558 518	48 646	8.7	68 887	12.3	8130	1.5

ND: not determined.
[a] We grouped countries by World Health Organization regions.

whether the verbal autopsy questionnaire has been translated into a local language, and the time delay between death and the autopsy interview; the diagnosis is more likely to be correct if the time delay is short.[8]

Our systematic review had several limitations. First, the number of studies included varied considerably between regions. In addition, the studies included diverse population groups and involved different autopsy methods. The resulting heterogeneity between the studies may limit the generalizability and comparability of our findings at regional and country levels. Second, our review calculated the cardiovascular disease mortality fraction only for individuals aged 15 years or older, because most studies included in the review reported cardiovascular disease mortality in that age range and not in younger age groups. Although focusing on older individuals provides valuable insights into the prevalence of death due to cardiovascular disease, including younger individuals would have helped identify emerging trends and assisted public health planning. Furthermore, the variation in age group categories between studies limited our ability to achieve a complete understanding of cardiovascular mortality across all age groups. Verbal autopsy studies should publish their results in a greater number of age groups, as this would

Fig. 2. **Risk-of-bias assessment, systematic review of verbal autopsies in low- and middle-income countries, 1992–2022**



enable the influence of age on cardiovascular disease mortality to be better investigated. Third, as mentioned, the generalizability of our study results was limited because most studies included were surveillance studies conducted in one specific geographical area, and most considered deaths occurring outside of a health-care setting. The use of a standardized assessment tool and cross-validation with other national and international data would increase the generalizability of verbal autopsy study findings to other populations.[9] Fourth, as we only calculated the cardiovascular disease mortality fraction for verbal autopsy deaths and not for all deaths, the mortality fraction is likely to differ from that derived from deaths in hospital or other locations. Finally, this systematic review included all data irrespective of when they had been collected. Although including only recent studies would have provided the most up-to-date data on cardiovascular mortality, we wanted our review to include as many large studies as possible. As the mortality fraction for cardiovascular disease has been increasing in low- and middle-income countries, the use of more recent data would likely have produced a higher mortality fraction. Moreover, newer studies may have used improved data collection methods and have been better at attributing the cause of death to cardiovascular disease. For example, computer-coded verbal autopsy has become more popular and has been shown to be more accurate for confirming death due to heart disease than physician-certified verbal autopsy.[62]

The verbal autopsy method also has limitations. The consistency of the symptoms reported by relatives during the verbal autopsy interview has been reported as low, especially when interviews take place a long time after the death.[63] Nevertheless, despite the low consistency, reported symptoms were generally sufficient for assigning the cause of death,[63] which is important given that verbal autopsy is only source of information about the cause of death at the population level in many low- and middle-income countries.[64] Future studies involving verbal autopsies should focus on minimizing recall bias by using validated questionnaires, and should ensure interviews take place within 3 months of the mourning period.[8] The studies in our review used different methods to ascertain the cause of death, with nearly half using the physician-certified method. A previous systematic review showed that physician-certified verbal autopsy was relatively poor at confirming heart disease compared with computer-coded verbal autopsy, though it was based on only three studies of hospital deaths.[65] More data are needed to understand the performance of different verbal autopsy methods in confirming different types of death, especially death at home. Verbal autopsy findings are specific to the population or setting in which the autopsies are conducted and it is, therefore, difficult to generalize them to other contexts. Recently, however, verbal autopsy has become routine in some settings. In particular, it has become part of civil registration and vital statistics systems in countries such as Bangladesh.[53] As a result, data on deaths due to cardiovascular disease and other causes will become more generalizable. Future studies using these data could validate verbal autopsy findings across diverse populations and geographical areas.

In many settings, the quality of verbal autopsy data directly affects health policy. A systematic review of 66 validation studies of verbal autopsy published in 2022 compared the cause of death assigned by verbal autopsy to the cause of death assigned by other methods such as autopsy diagnosis and hospital diagnosis.[66] The review found that the majority of studies reported an acceptable level of agreement between verbal autopsy and the comparison method as assessed, using measures such as chance-corrected concordance, kappa coefficients, sensitivity, specificity or the positive predictive value.

Although the review confirmed the validity of verbal autopsy methods, it also highlighted gaps in the quality of verbal autopsy studies involving, for example, the use of non-validated questionnaires; the time delay between death and the verbal autopsy interview; and problems with the cause-of-death assignment technique.[66]

In conclusion, our systematic review provides evidence that the burden of cardiovascular disease deaths outside health-care settings is substantial. More data and research are needed to gain a better understanding of whether variations in the cardiovascular disease mortality fraction for community deaths across regions, subnational populations and sexes are indicative of health inequalities. Future verbal autopsy studies examining cardiovascular disease mortality should be more representative of the national population and should ensure minimal recall bias. Further investment to increase coverage of verbal autopsies in low- and middle-income countries would help fill gaps in cardiovascular disease mortality data, and improve the monitoring of national, regional and global health goals. ■

Competing interests: None declared.

ملخص

معدل الوفيات الناتجة عن أمراض القلب والأوعية الدموية على أساس التشريح السردي في الدول ذات الدخل المنخفض والدخل المتوسط: مراجعة منهجية

الغرض إجراء مراجعة منهجية لدراسات التشريح السردي في الدول ذات الدخل المنخفض والدخل المتوسطة، لتقدير نسبة الوفيات الناتجة عن أمراض القلب والأوعية الدموية.

الطريقة قمنا بالبحث في قواعد بيانات MEDLINE®، و Embase®، وScopus، عن دراسات التشريح السردي في الدول ذات الدخل المنخفض والدخل المتوسطة الدخل، والتي أبلغت عن الوفيات ناتجة عن أمراض القلب والأوعية الدموية. قام اثنان من المراجعين بفحص الدراسات، واستخراج البيانات، وتقييم جودة الدراسة. قمنا بحساب نسب الوفيات الناتجة بشكل محدد عن أمراض القلب والأوعية الدموية لكل دراسة، سواء بوجه عام ووفقًا للعمر، والجنس، والموقع الجغرافي، ونوع مرض القلب والأوعية الدموية.

النتائج قمنا بتحديد 42 دراسة لإدراجها في المراجعة. بوجه عام، كانت نسب الوفيات الناتجة بشكل محدد عن أمراض القلب والأوعية الدموية للأشخاص الذين تبلغ أعمارهم 15 عامًا وأكبر، هي 22.9%. كانت هذه النسبة أعلى بشكل عام للذكور (24.7%) عن الإناث (20.9%)، لكن النمط اختلف عبر مناطق منظمة الصحة العالمية. تم الإبلاغ عن أعلى نسبة وفيات بأمراض القلب والأوعية الدموية في منطقة غرب المحيط الهادئ (26.3%)، وتليها منطقة جنوب شرق آسيا (24.1%)، والإقليم الأفريقي (12.7%). كانت نسبة الوفيات الناتجة عن أمراض القلب والأوعية الدموية أعلى في التجمعات السكانية الحضرية عنها في التجمعات السكانية الريفية في جميع المناطق، باستثناء إقليم جنوب شرق آسيا. كانت نسبة الوفيات بسبب مرض القلب الإقفاري (12.3%) أعلى من نسبة الوفيات بسبب السكتة الدماغية (8.7%). بشكل عام، تم الإبلاغ عن 69.4% من وفيات أمراض القلب والأوعية الدموية لدى أشخاص تبلغ أعمارهم 65 عامًا فما فوق.

الاستنتاج إن عبء الوفيات الناتجة عن أمراض القلب والأوعية الدموية خارج أماكن الرعاية الصحية، في الدول ذات الدخل المنخفض والدخل المتوسط، هو عبء ضخم. إن زيادة تغطية التشريح السردي في هذه الدول يمكن أن تساعد على سد الفجوات في بيانات الوفيات الناتجة عن أمراض القلب والأوعية الدموية، وتحسين رصد الأهداف الصحية الوطنية والإقليمية والعالمية.

摘要

中低收入国家基于死因推断的心血管疾病死亡率：系统评价

目的 旨在对中低收入国家的死因推断研究进行系统评价，以估算心血管疾病死亡率。

方法 我们搜索了 MEDLINE®、Embase® 和 Scopus 数据库，以查询报告心血管疾病死亡情况的中低收入国家死因推断研究。两名评审员对这类研究进行了筛选、提取了数据并评估了研究质量。我们基于每项研究计算了心血管疾病病因特异性死亡率，包括总体死亡率以及按年龄、性别、地理位置和心血管疾病类型分别计算的死亡率。

结果 我们确定了 42 项研究并将其纳入系统评价。总体而言，15 岁及以上人群的心血管疾病病因特异性死亡率为 22.9%。男性 (24.7%) 的这一比例通常高于女性 (20.9%)，但世界卫生组织各地区的情况各不相同。西太平洋地区 (26.3%) 报告的心血管疾病死亡率最高，其次是东南亚地区 (24.1%) 和非洲地区 (12.7%)。除东南亚地区以外，其他所有地区城市人口的心血管疾病死亡率均高于农村人口。缺血性心脏病死亡率 (12.3%) 高于中风死亡率 (8.7%)。总体而言，根据报告，69.4% 的心血管疾病死亡病例为 65 岁及以上人群。

结论 在中低收入国家，医疗机构范围以外的心血管疾病死亡负担非常巨大。扩大这些国家的死因推断的覆盖范围可能有助于填补心血管疾病死亡率数据方面的空缺，并加强对国家、区域和全球健康目标的监测。

Résumé

Mortalité cardiovasculaire déterminée sur la base d'autopsies verbales dans les pays à revenu faible et intermédiaire: revue systématique

Objectif Mener une revue systématique des études d'autopsie verbale dans les pays à revenu faible et intermédiaire afin d'estimer la part des décès causés par des maladies cardiovasculaires.

Méthodes Nous avons exploré les bases de données MEDLINE®, Embase® et Scopus à la recherche d'études d'autopsie verbale signalant des décès liés à une maladie cardiovasculaire dans les pays à revenu faible et intermédiaire. Deux réviseurs ont passé ces études au crible, en ont extrait des informations et ont évalué leur qualité. Pour chaque étude, nous avons calculé la part de mortalité par cause pour les maladies cardiovasculaires, tant de manière globale qu'en fonction de l'âge, du sexe, de la situation géographique et du type de maladie cardiovasculaire.

Résultats Nous avons identifié 42 études à inclure dans la revue. Dans l'ensemble, la part de mortalité par cause pour les maladies cardiovasculaires s'élevait à 22,9% pour les personnes âgées de 15 ans et plus. Cette part était généralement plus importante chez les hommes (24,7%) que chez les femmes (20,9%), mais le schéma variait selon les régions de l'Organisation mondiale de la Santé. C'est dans la Région du Pacifique occidental que le plus haut taux de mortalité cardiovasculaire a été observé (26,3%), puis dans la Région d'Asie du Sud-Est (24,1%) et dans la Région africaine (12,7%). La part de mortalité due aux maladies cardiovasculaires était plus grande au sein des populations urbaines plutôt que rurales dans toutes les régions, à l'exception de la Région d'Asie du Sud-Est. La part de mortalité liée aux cardiopathies ischémiques (12,3%) était supérieure à celle des AVC (8,7%). Au total, 69,4% des décès cardiovasculaires ont été constatés chez des personnes âgées de 65 ans ou plus.

Conclusion L'impact des décès causés par une maladie cardiovasculaire en dehors des structures de santé dans les pays à revenu faible et intermédiaire est considérable. Étendre la couverture des autopsies verbales dans ces pays pourrait contribuer à combler les lacunes dans les données sur la mortalité cardiovasculaire et à améliorer le suivi des objectifs nationaux, régionaux et mondiaux en matière de santé.

Резюме

Смертность от сердечно-сосудистых заболеваний на основе данных вербальной аутопсии в странах с низким и средним уровнем дохода: систематический обзор

Цель Провести систематический обзор исследований вербальных аутопсий в странах с низким и средним уровнем дохода для оценки доли смертей от сердечно-сосудистых заболеваний.

Методы Был проведен поиск в базах данных MEDLINE®, Embase® и Scopus по исследованиям вербальных аутопсий в странах с низким и средним уровнем дохода, в которых сообщалось о случаях смерти от сердечно-сосудистых заболеваний. Два рецензента отбирали исследования, извлекали данные и оценивали качество исследований. По результатам каждого исследования была рассчитана доля смертности от сердечно-сосудистых заболеваний, обусловленная конкретной причиной, как в целом, так и в зависимости от возраста, пола, географического положения и типа сердечно-сосудистого заболевания.

Результаты Было определено 42 исследования для включения в обзор. В целом доля смертности от сердечно-сосудистых заболеваний, обусловленная конкретной причиной, среди людей в возрасте 15 лет и старше составила 22,9%. Как правило, эта доля была выше у мужчин (24,7%), чем у женщин (20,9%). Однако в разных регионах Всемирной организации здравоохранения она была разной. Самая высокая доля смертности от сердечно-сосудистых заболеваний была зарегистрирована в регионе Западной части Тихого океана (26,3%), за ним следуют регион Юго-Восточной Азии (24,1%) и регион Африки (12,7%). Доля смертности от сердечно-сосудистых заболеваний была выше среди городского населения по сравнению с сельским во всех регионах, за исключением региона Юго-Восточной Азии. Доля смертности от ишемической болезни сердца (12,3%) превышала долю смертности от инсульта (8,7%). В целом 69,4% смертей от сердечно-сосудистых заболеваний приходилось на людей в возрасте 65 лет и старше.

Вывод В странах с низким и средним уровнем дохода число смертей от сердечно-сосудистых заболеваний вне медицинских учреждений является значительным. Расширение охвата вербальными аутопсиями в этих странах может помочь заполнить пробелы в данных о смертности от сердечно-сосудистых заболеваний и способствовать улучшению мониторинга национальных, региональных и глобальных целей в области здравоохранения.

Resumen

Mortalidad por enfermedad cardiovascular y autopsia verbal en países con ingresos medios y bajos: una revisión sistemática

Objetivo Llevar a cabo una revisión sistemática de los estudios sobre autopsias verbales de países con ingresos medios y bajos para estimar la proporción de fallecimientos causados por enfermedades cardiovasculares.

Métodos Buscamos en bases de datos como MEDLINE®, Embase® y Scopus para acceder a estudios sobre autopsias verbales de países con ingresos medios y bajos que hubieran registrado fallecimientos causados por enfermedades cardiovasculares. Dos revisores analizaron los estudios, extrajeron datos y evaluaron la calidad de dichos estudios. Calculamos las fracciones de mortalidad por enfermedad cardiovascular como causa específica en cada uno de los estudios, de manera general y según la edad, el sexo, la ubicación geográfica y el tipo de enfermedad cardiovascular.

Resultados Seleccionamos 42 estudios para incluirlos en la revisión. En general, las fracciones de mortalidad por enfermedad cardiovascular como causa específica en personas con una edad de 15 años o superior fueron del 22,9%. Por lo general, esta fracción fue más elevada en el caso de los hombres (24,7%) que en el de las mujeres (20,9%), pero el patrón varió entre las diferentes regiones de la Organización Mundial de la Salud. La fracción más alta de mortalidad por enfermedad cardiovascular

se registró en la Región del Pacífico Occidental (26,3%), seguida de la Región de Asia Sudoriental (24,1%) y la Región de África (12,7%). La fracción de mortalidad por enfermedad cardiovascular fue más elevada en las poblaciones urbanas que en las rurales en todas las regiones, excepto en la Región de Asia Sudoriental. La fracción de mortalidad por cardiopatía isquémica (12,3%) fue superior a la de ictus (8,7%). En general, el 69,4% de los fallecimientos por enfermedad cardiovascular se registró en personas de 65 años o más.

Conclusión La carga de fallecimientos por enfermedad cardiovascular fuera de los centros de atención sanitaria en los países con ingresos medios y bajos es considerable. El aumento de la cobertura de las autopsias verbales en estos países podría ayudar a subsanar la falta de datos sobre mortalidad por enfermedad cardiovascular, y mejorar el control de los objetivos de salud a nivel nacional, regional y mundial.

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